**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-22XXXXX**

**Electronic Meeting, 10– 19 October 2022**

**Agenda item:** 6.7.4

**Source:** Hisashi Onozawa (Nokia)

**Title:** Email discussion summary for [104-bis-e][130] FR2\_enh\_req\_Ph3\_part1

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

This email discussion thread for the agenda items 6.7, 6.7.1, and 6.7.3 in RAN4#104-bi-e regarding the beam correspondence requirement in initial access and RRC\_CONNECTED in the work item RP-222228　on NR RF requirements enhancement for FR2, Phase 3.

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: BC requirement

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2216348 | Xiaomi,Nokia | TR38.891 v 0.1.0 for NR RF requirements enhancement for frequency range 2 (FR2), Phase 3 |
| [**R4-2216252**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216252.zip) | Sony, Ericsson | **Observation 1: with maximum output power, it can be assumed that UE can use all the antenna elements in IA and is feasible to form a narrow beam to transmit Msg1.**  **Observation 2: For a UE that operates in the beam correspondence manner, the correct UE behavior when it can’t receive RAR response is to form a narrow beam towards the direction of the SSB.**  **Observation 3: Apply the same spherical coverage requirement as in the connected mode to verify the UE beam correspondence in IA can ensure the device performs similarly in IA and connected mode.**  **Observation 4: the test of RAR could be exempt if the same spherical coverage requirement as in the connected mode can be used for Msg1.**  **Proposal 1: To verify the beam correspondence performance in IA, the UE should meet the same spherical coverage requirement as in the connected mode for Msg1.**  **Proposal 2: Focusing on the beam correspondence requirement for IA and checking if the same requirement can be re-used for other scenarios once the core requirement for IA is stable.**  **Proposal 3: The RAR test cannot be precluded until the spherical coverage requirement for Msg1 is clear.**  **Proposal 4: RAN4 shall also determine the side condition of SSB for the EIRP spherical coverage test of Msg1.** |
| [**R4-2216785**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216785.zip) | Qualcomm Incorporated | **Proposal 1: Msg1 EIRP spherical coverage requirements are the same as those for connected mode DFT-s-QPSK.**  **Proposal2 : The detail of how to enable the UE to transmit at max. output power is left to RAN5.**  **Proposal 3: Reception of MSG3 in the TE indicates successful reception and decode of MSG2 in the UE.**  **Proposal 4: To leverage connected mode PDSCH sensitivity requirements, the PDSCH part of MSG2 is also configured as MCS 4.**  **Proposal 5: For a combined MSG1+MSG2 spherical coverage requirement, a common spherical coverage criterion is used, where common coverage is defined as the fraction of directions for which the UE meets both, the EIRP spherical coverage requirement for MSG1 and the EIS spherical coverage requirement for MSG2.**  **Proposal 6: For a Msg3 requirement, verification can be skipped for Ues that support *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceSSB-based-r16.*** |
| [**R4-2215479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215479.zip) | CMCC | **Observation 1: there are still two kinds of R18 UE at initial access and RRC\_INACTIVE**   * **one with better performance without tolerance requirements like UE without beam sweeping in R16** * **another with relatively bad BC performance like R16 UE with beam sweeping which still need the tolerance requirement although in theory such UE should support BC without beam sweeping at initial access state.**   **Proposal 1: it’s suggested to study the tolerance requirements especially for UE support BC with beam sweeping in RRC\_CONNECTED.**  **Observation 2: to make the tolerance testing operational, we may need to allow UE to sweep UL beam during the test to find the best-matched beam at initial access state or at RRC\_INACTIVE state.** |
| [**R4-2215511**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215511.zip) | Nokia, Nokia Shanghai Bell | **Observation 1:** 2 step RA SDT has a higher payload as compared to a 4 step RA SDT.  **Observation 2:** Beam Correspondence tolerance requirements in Connected mode provided relaxations for early 5G handsets.  **Observation 3:** MsgA in the 2 step Random access has a payload as well. UE Tx power for sending MsgA is higher than for Msg1 in a legacy 4 step random access scenario.  **Proposal 1:** Beam correspondence requirements need to be differentiated based on the RA type and the SDT type, e.g., 2-step or 4-step RA procedures.  **Proposal 2:** Beam Correspondence tolerance requirements need to be redefined for Idle and Inactive modes owing to limited time to measure due to DRX operations.  **Proposal 3:** SSB\_RP values for IDLE/INACTIVE states may be different for a 2 step RA procedure compared to a 4 step RA procedure due to payload difference between MsgA and Msg1.  **Proposal 4:** Benefits of the RAR test need to be shown compared to existing methods before inclusion in the tests. |
| [**R4-2215630**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215630.zip) | Apple | **Proposal 1: It is proposed to define the same requirement for RA-SDT, CG-SDT and initial access.**  **Proposal 2: It is proposed to reuse the only SSB based beam correspondence requirement in RRC\_CONNECTED state for IA, RA-SDT and CG-SDT.**  **Proposal 3: Same requirement apply for MSG1 and MSG A.**  **Proposal 4: It is proposed to test beam correspondence requirement only in initial access for MSG1.** |
| [**R4-2215854**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215854.zip) | Huawei, HiSilicon | ***Proposal 1:*** *Only initial access is considered for beam correspondence requirements definition and verification.*  ***Proposal 2:*** *MsgA is not considered for beam correspondence requirements definition and verification.*  ***Proposal 3:*** *Only Msg 1 is considered for beam correspondence requirements definition and verification.* |
| [**R4-2216129**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216129.zip) | vivo | **Observation 1:** The *beamCorrespondenceSSB-based-r16* and *beamCorrespondenceWithoutUL-BeamSweeping* can be extended to non-RRC\_CONNECTED state if fine beam is also used.  **Observation 2:** The analysis of beam correspondence for fine beam in previous release cannot apply to rough beam directly.  **Observation 3:** The beam correspondence without beam sweeping is not mandatory even in RRC\_CONNECTED state.  **Observation 4:** RAR reception verification will enlarge the test complexity and test time significantly.  **Proposal 1:** The fine-beam based beam correspondence without beam sweeping during non-CONNECTED state can be verified in RRC\_CONNECTED state through traditional requirement.  **Proposal 2:** A new capability, e.g., *beamCorrespondenceDuringNon-RRC\_CONNECTED,* should be introduce to indicate whether beam correspondence with rough beam during non-CONNECTED state is supported.  **Proposal 3:** The beam correspondence without beam sweeping during non-CONNECTED state should be optional.  **Proposal 4:** The beam correspondence requirement can be same for CG-SDT, RA-SDT and initial access.  **Proposal 5:** No need to further verify the performance of RAR reception. |
| [**R4-2216351**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216351.zip) | Xiaomi | **Proposal 1: Msg 1 and Msg A for initial access in RRC\_IDLE state and RRC\_INACTIVE state could have the same beam correspondence requirements based PRACH test, and only one of 2step RA and 4step RA procedure need be tested.**  **Proposal 2: RA-SDT could have the same beam correspondence requirements with initial access in RRC\_IDLE state and RRC\_INACTIVE state for non-SDT.**  **Proposal 3: The beam correspondence requirements for initial access in RRC\_IDLE state and RRC\_INACTIVE state and RA-SDT should be defined based on PRACH.**  **Proposal 4: It is not necessary to verify the similarity between TX and Rx beams by check the RAR reception.**  **Proposal 5: CG-SDT could reuse the SSB based beam correspondence requirements for R-16 RRC\_Connected state.**  **Proposal 6: The min SNR level of SSB for side condition of SSB based need re-evaluate compare to the value for R-16 RRC\_Connected state.** |
| [**R4-2216438**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216438.zip) | OPPO | ***Observation 1: Without differentiating rough beam and fine beam implementation in initial access, the beam correspondence requirements need to cover both and use the worse scenario (rough beam) to define requirements.***  ***Proposal 1: In order to cover both rough beam and fine beam implementation in initial access, propose to use the worse scenario (rough beam) as reference to define beam correspondence requirements.***  ***Proposal 2: By considering the gain difference between rough beam in initial access and fine beam in connected, propose to consider define 7dB lower beam correspondence requirement (peak EIRP and spherical) comparing to connected mode as starting point.***  ***Observation 2: UE may use a good beam instead of best beam to transmit RACH when it’s measured DL signal quality is good enough for RACH. This will cause the UE performance be underestimated if test the peak and spherical requirements.***  ***Proposal 3: Further consider the situation that UE may use a good but not the best beam to transmit RACH to speed up initial access.***  ***Observation 3: There is no difference in Beam correspondence requirement for initial access and RRC Inactive from UE Tx power perspective.***  ***Proposal 4: Same beam correspondence requirements are applied for initial access and RRC Inactive.*** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1 BC requirement in IA and RRC\_INACTIVE

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**

* Proposals
  + Option 1: only EIRP spherical coverage is specified. Supported by Samsung, vivo, Huawei, Xiaomi, OPPO, Sony (if the same as connected), Ericsson, Verizon
  + Option 2: both EIRP spherical coverage and min peak EIRP are specified. Supported by Qualcomm, vivo, OPPO, Apple, Sony (as fallback), Ericsson, AT&T, Verizon
  + Option 3: all of min peak EIRP, EIRP spherical coverage, and BC tolerance are specified. Supported by CMCC, Nokia
  + Option 4: Others (such as RAR as an additional requirement on top of option 1, 2 or 3) Supported by Sony (as fallback), Ericsson
* Recommended WF
  + In GTW, discuss whether min peak EIRP is included or not in the BC criteria. (Considering rough/fine beam assumption.)

**Issue 1-1-2: RAR test**

* Proposals
  + Option 1: yes, RAR test is included. Supported by Ericsson, AT&T, Verizon
  + Option 2: no, RAR test is not needed. Supported by Qualcomm, Samsung, vivo, Huawei, CMCC, Nokia, Xiaomi, OPPO, Apple
  + Option 3: others Supported by Sony
* Recommended WF
  + In GTW, discuss the necessity of RAR requirement

**Issue 1-1-3: msg3**

* Proposals
  + Option 1: verification can be skipped for Ues that support *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceSSB-based-r16*. Supported by Qualcomm, vivo, Sony, Ericsson, AT&T, Verizon
  + Option 2: no need to verify msg3 requirement regardless of UE capability Supported by Samsung, Huawei, CMCC, Nokia, Xiaomi, OPPO, Apple, Sony, Verizon
  + Option 3: need to verify msg3 requirement regardless of UE capability
* Recommended WF
  + In GTW, discuss the necessity of msg3 requirement.

**Issue 1-1-4: msg 1 vs msg A**

* Proposals
  + Option 1: msg 1 and msg A requirement are the same Supported by CMCC, Xiaomi, Apple, Sony
  + Option 2: only testing msg 1 is enough. Supported by Qualcomm, Samsung, vivo, Huawei, CMCC, Xiaomi, OPPO, Apple, Ericsson, AT&T
  + Option 3: msg A requirement is more stringent. Supported by Nokia, Sony
* Recommended WF
  + In GTW, discuss the necessity of msgA requirement.

**Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**

* Proposals
  + Option 1: The same requirement as Rel-16 SSB applicable to IA, RA-SDT and CG-SDT Supported by Qualcomm, vivo, CMCC, Apple, Sony, Ericsson, AT&T, Verizon
  + Option 2: The same requirement as Rel-16 SSB applicable only to CG-SDT Supported by Xiaomi
  + Option 3: Requirement are different from Rel-16 SSB for IA, RA-SDT and CG-SDT Supported by Huawei, Nokia, OPPO
  + Option 4: The beam assumption should be agreed firstly. Supported by Samsung
* Recommended WF
  + In GTW, discuss whether Rel-16 SSB BC requirement can be reused.

**Issue 1-1-6: Which scenario shall be included in core requirement**

* Proposals
  + Option 1: IA, RA-SDT and CG-SDT Supported by CMCC, Nokia, Sony (Test can be reduced), AT&T (Test can be reduced), Verizon (Agree with Sony)
  + Option 2: Focus on IA Supported by Qualcomm, Samsung, vivo, Huawei, CMCC, Xiaomi, OPPO, Ericsson
  + Option 3: Others
* Recommended WF
  + In GTW, discuss between option 1 and option 2.

**Issue 1-1-7: waveform**

* Proposals
  + Option 1: EIRP spherical coverage requirements are the same as those for connected mode DFT-s-QPSK Supported by Qualcomm, Samsung, vivo, Xiaomi, OPPO, Apple, Verizon
  + Option 2: Others Supported by Huawei, Nokia
* Recommended WF
  + TBA

**Issue 1-1-8: BC tolerance metric**

* Proposals
  + Option 1: Required for UE not supporting BC without UL beam sweep Supported by CMCC
  + Option 2: Required for DRX Supported by Nokia
  + Option 3: Further consider the situation that UE may use a good but not the best beam to transmit RACH to speed up initial access. Supported by Nokia, OPPO
  + Option 4: No need to specify tolerance. Supported by Qualcomm, Samsung, vivo, Huawei, Xiaomi, Sony, AT&T, Verizon
  + Option 5: BC tolerance should be allowed. Supported by Ericsson
* Recommended WF
  + In GTW, discuss whether tolerance is specified

**Issue 1-1-9: UE capability**

* Proposals
  + Option 1: specify requirement only for UE supporting *beamCorrespondenceSSB-based-r16* and *beamCorrespondenceWithoutUL-BeamSweeping* Supported by Nokia
  + Option 2: specify requirement for any UE Supported by Qualcomm, Samsung, Huawei, Xiaomi, OPPO, Apple, Sony, Ericsson, AT&T, Verizon
  + Option 3: A new UE capability is required such as *beamCorrespondenceDuringNon-RRC\_CONNECTED* Supported by vivo
* Recommended WF
  + TBA

**Issue 1-1-10: Side conditions**

* Proposals
  + Option 1: Determine the side condition of SSB for the EIRP spherical coverage test of Msg1. Supported by Qualcomm, Samsung, vivo, Huawei, CMCC, Nokia, Xiaomi, OPPO, Apple, Sony, Ericsson), AT&T, Verizon
  + Option 2: Others
* Recommended WF
  + Option 1

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |
| Qualcomm | Issue 1-1-1: Option 2  Issue 1-1-2: Option 2. Note: If it is decided that RAR needs to be tested, we have a set of proposals for consideration.  Issue 1-1-3: options are not mutually exclusive, so we comment on each  Option 1 : support, as proponents  Option 2 vs 3: no strong view  Issue 1-1-4: no strong view, prefer option 2  Issue 1-1-5: Option 1  Issue 1-1-6: Option 2  Issue 1-1-7: Option 1  Issue 1-1-8: Option 4 other. We do not see the need for BC tolerance relaxation for Rel-18 Ues.  Issue 1-1-9: Option 2  Issue 1-1-10: option 1, can re-use Rel-16 SSB-only side conditions. |
| Samsung | **Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**  Option 1, especially if rough beam would be assumed.  **Issue 1-1-2: RAR test**  Option 2.  **Issue 1-1-3: msg3**  Option 2.  **Issue 1-1-4: msg 1 vs msg A**  Option 2.  **Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**  The beam assumption should be agreed firstly. If rough beam is assumed, more relaxation on top of Rel-16 requirements is needed.  **Issue 1-1-6: Which scenario shall be included in core requirement**  Option 2.  **Issue 1-1-7: waveform**  Option 1.  **Issue 1-1-8: BC tolerance metric**  If following the WID:  • Specify UE beam correspondence requirements for initial access and RRC\_INACTIVE state, for SSB-based beam correspondence without UL beam sweeping [RAN4 RF]  It seems not necessary to specify BC tolerance.  **Issue 1-1-9: UE capability**  Option 2. We think the intention should be for any UE. In RRC connected mode, beam correspondence is mandatory though there are several different beam correspondence capabilities. In initial access gNB could not know UE capability ahead of time. So in our view the work is to specify a minimum requirement for all kinds of UE unless the TX panel and RX panel are separated.  **Issue 1-1-10: Side conditions**  Option 1. Beam assumption should be agreed before the side condition calculation. |
| Vivo | Issue 1-1-1:  Both option 1 and option 2 are ok for us  Issue 1-1-2:  Option 2.  Issue 1-1-3:  Support option 1  Issue 1-1-4:  Prefer option 2, for msg A, maybe we can use same approach as option 1 in issue 1-1-3  Issue 1-1-5:  Option 1, same requirement can be applied only if these cases use same beam type as baseline.  Issue 1-1-6:  Option 2.  Issue 1-1-7:  Option 1 is ok, ZC OFDM has similar PAPR to DFT-s-QPSK.  Issue 1-1-8:  Agree with Qualcomm and Samsung, the tolerance is not needed.  Issue 1-1-9:  Option 3. We understand the intention is for all UE but we also afraid that there will be some  potential conflicts if we mandate the BC for IA.   1. if we reuse same requirement from SSB-only BC to IA/SDT, what is the difference between verify it in RRC\_CONNECTED or RRC\_IDLE? Does it meaningful to verify exactly same BC requirement in different RRC states? 2. If BC for IA is mandatory, do we still need *beamCorrespondenceSSB-based-r16* and *beamCorrespondenceWithoutUL-BeamSweeping* which is optional?   Issue 1-1-10:  Ok with option1, R16 SSB-only side condition can be starting point. |
| Huawei | **Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**  Option 1. UE might use a ‘good enough’ beam to transmit preamble, no matter ‘fine beam’ or ‘rough beam’ is used.  **Issue 1-1-2: RAR test**  Option 2. RAR is transmitted in the same direction of SSB. By measuring the preamble transmitted by UE in the same direction of SSB, the tx/rx similarity is already verified.  **Issue 1-1-3: msg3**  Option 2. If UE’s BC performance is already verified with preamble, there is no need to further check msg3 as UE is expected to transmit msg3 using the same Tx beam as preamble.  **Issue 1-1-4: msg 1 vs msg A**  Option 2. For both msg 1 and msg A, UE’s transmission begins with preamble. Verifying the preamble for msg1 would be enough.  **Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**  Option 3. Rough beam needs to be considered.  **Issue 1-1-6: Which scenario shall be included in core requirement**  Option 2.  **Issue 1-1-7: waveform**  Option 2. The connected mode requirements are based on ‘fine’ beam assumption. For IA the requirements need to be revisited.  **Issue 1-1-8: BC tolerance metric**  For IA, all the Ues are expected to meet the same BC requirements, i.e. the spherical requirements. There is no need to additionally specify the tolerance requirement.  **Issue 1-1-9: UE capability**  Option 2. The requirement shall apply to all Ues. IA is a basic function and is of the top importance for the network performance. If we allow some UE to not comply with the requirement, the network will have no means to assist the UE to successfully access to the network.  **Issue 1-1-10: Side conditions**  Option 1. |
| CMCC | **Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**  Option 3. Or at least spherical coverage and BC tolerance if companies think UE will use its best beam to transmit preamble. The reason for BC tolerance is as below.  There are still two kinds of BC capability at RRC\_CONNECTED state. For the UE with relatively bad BC performance, it needs beam sweeping. Although at initial access state, UE don’t need beam sweeping. But bad UE is still the bad UE and its performance is still limited without any enhancement at initial access stage compared with RRC\_CONNECTED. If there is no tolerance requirement, we are afraid the performance of BC can’t be guaranteed. This is the reason why we think tolerance is still required.  **Issue 1-1-2: RAR test**  Option 2. The preamble Tx direction is the same as SSB receiver direction. So Tx and Rx relationship has been verified and there is no need for RAR test.  **Issue 1-1-3: msg3**  Option 2. It seems preamble Tx is already enough.  **Issue 1-1-4: msg 1 vs msg A**  Option 1 and 2. We don’t see the need to define more stringent requirements for MSG A.  **Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**  Option 1. We still don’t see any difference among all these three scenarios since all of them are based on SSB and rough beam.  **Issue 1-1-6: Which scenario shall be included in core requirement**  We don’t see any difference so both option 1 and option 2 are OK.  **Issue 1-1-7: waveform**  .  **Issue 1-1-8: BC tolerance metric**  The same as issue 1-1-1.  **Issue 1-1-9: UE capability**  Option 2.  **Issue 1-1-10: Side conditions**  Option 1. |
| Nokia | **Issue 1-1-1:** Option 3. However, we suggest to focus on EIRP spherical coverage and BC tolerance specifications initially.  **Issue 1-1-2: Option 2.** We believe that testing the RAR will be more of a sanity check.  **Issue 1-1-3:** Option 2  **Issue 1-1-4:** Option 3. As compared to msg 1, Msg A has a payload as well. Hence BC requirements need to be comparatively stricter for msgA as compared to msg1.  **Issue 1-1-5:** Option 3. In INACTIVE mode, UE can do SDT. In case of RA-SDT, the 2 step RA SDT will have a payload to send in msgA. BC requirements need to be defined keeping this in mind.  **Issue 1-1-6:** Option 1. In inactive mode, UE can do SDT. In case of RA-SDT, the 2 step RA SDT will have a payload to transmit in msgA. BC requirements need to be defined keeping this in mind.  **Issue 1-1-7:** Option 2**.** While DFT-s-QPSK can be used as a baseline to define spherical coverage. The requirement values in IDLE and INACTIVE may not be identical.  **Issue 1-1-8:** Option 2 and Option 3  **Issue 1-1-9:** Option 1. We disagree with Option 3. There should be no UE capability fragmentation for non-RRC connected state as there is no controllability from the network side  **Issue 1-1-10**: Option 1 |
| Xiaomi | **Issue 1-1-1:** Option 1.  **Issue 1-1-2:** Option 2, if UE’s BC performance in IA has already verified with preamble based on SSB measurement, UE will receive RAR at the same beam with detected SSB.  **Issue 1-1-3:** Option 2, if UE’s BC performance in IA has already verified with preamble based on SSB measurement, UE will receive RAR at the same beam with detected SSB, and then transmit msg3 using the same Tx beam with msg1.  **Issue 1-1-4:** Option 1 and Option 2, although msg A bearing preamble and PUSCH has heavier payload compared to msg1, but the payload for preamble are the same with msg1, and preamble and PUSCH are TDM for msg A, therefore, msgA and msg1 could have the same requirement based on the preamble, and just testing msg1 is enough.  **Issue 1-1-5:** Option 2, for CG-SDT, I think the UE can send the SDT directly, once the UE detected the SSB, it don’t need to consider the access time like the RA process, the UE can use more antenna elements to form a fine beam like in the connected state.  **Issue 1-1-6:** Option 2.  **Issue 1-1-7:** Option 1.  **Issue 1-1-8:** no beam sweeping no BC tolerance.  **Issue 1-1-9:** Option 2.  **Issue 1-1-10:** Option 1. |
| OPPO | **Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**  Option 1 and 2 are ok. But if specify the peak EIRP requirements, then beam type differences needs to be accounted.  **Issue 1-1-2: RAR test**  Option 2: no, RAR test is not needed.  **Issue 1-1-3: msg3**  Option 2: no need to verify msg3 requirement regardless of UE capability.  **Issue 1-1-4: msg 1 vs msg A**  Option 2: only testing msg 1 is enough.  **Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**  Option 3: Requirement are different from Rel-16 SSB for IA, RA-SDT and CG-SDT.  **Issue 1-1-6: Which scenario shall be included in core requirement**  Option 2: Focus on IA  **Issue 1-1-7: waveform**  Option 1: EIRP spherical coverage requirements are the same as those for connected mode DFT-s-QPSK  **Issue 1-1-8: BC tolerance metric**  Option 3: Further consider the situation that UE may use a good but not the best beam to transmit RACH to speed up initial access.  **Issue 1-1-9: UE capability**  Option 2: specify requirement for any UE  **Issue 1-1-10: Side conditions**  Option 1: Determine the side condition of SSB for the EIRP spherical coverage test of Msg1. |
| Apple | Issue 1-1-1: Option 2 is fine for us. Option 1 is also fine.  Issue 1-1-2: Option 2.  Issue 1-1-3: Option 2  Issue 1-1-4: Option 1 and Option 2 are not conflict in our view. Option 1 is talking about requirement while Option 2 is talking about test coverage. Test can be done only for MSG 1 while requirement should be applicable for both. Regarding option 3, we should like to understand why the requirement should be more stringent?  Issue 1-1-5: Option 1  Issue 1-1-6: wondering why one requirement cannot be applicable to all scenarios? Can the proponent of option 2 clarify? Is it from requirement point of view or from test point of view?  Issue 1-1-7: Fine with option 1  Issue 1-1-8: motivation is not clear. Need more clarification.  Issue 1-1-9: Option 2  Issue 1-1-10: Option 1, Rel-16 SSB-only side conditions can be reused. |
| Nokia | **Issue 1-1-4: msg 1 vs msg A**  due to the msgA has payload, the stricter requirement is needed for msgA than msg1. Generally, transmitting more data means more power/SNR is required. Therefore, for msgA, we suggest to tighten the requirement compared with requirement of msg1, in terms of min peak EIRP and tolerance.  **Issue 1-1-8: BC tolerance metric**  The DRX have short and long cycles, and the cycles will continue for a long time and the channel can change. Also SDT is used with DRX, long DRX have smaller payload, short DRX have higher payload, therefore short DRX need stricter requirement and long DRX need relax requirement for supporting SDT.  Therefore we suggest considering the different requirements for DRX or adding tolerance. |
| Sony | Issue 1-1-1:  The outcome of this issue depends on multiple factors:   1. In general, we support to re-use the beam correspondence requirement in the connected mode without uplink beam sweeping. With having said that, both peak EIRP and spherical coverage requirement should be specified, and the minimum requirement from the connected mode can be re-used. 2. If the proposal above is agreeable, it is fine for us to consider to not define the RAR requirement, since we have at least ensure the UE has the same BC performance as in connected mode. However, if that is not case, for example, large performance relaxation will be pursed to consider different beam patterns, then it is more feasible to also test RAR reception to verify the similar between the Tx and Rx beam since this method is beam pattern agnostic. 3. As a final remark, we also have shown in our simulation (**[R4-2216252](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216252.zip)**) that it is possible to meet the minimum spherical coverage requirement with a wide beam. Therefore, only specify the spherical coverage requirement and re-sue the same requirement as in connected mode can be taken as a fallback solution.   Therefore, our view on each proposal is as below:  Option 1: support under the assumption that the same minimum requirement as in the connected mode would be re-used.  Option 2: can be considered as a fallback solution if option 1 is not agreeable or if the requirement from the connected mode can’t be re-used  Option 3: No. No BC tolerance should be allowed for initial access  Option 4: can be considered as a fallback solution if option 1 is not agreeable or if the requirement from the connected mode can’t be re-used  Our proposal for this issue is that we should at least specify the EIRP spherical coverage requirement, and whether to test peak EIRP and RAR is pending on the discussion of the EIRP spherical coverage requirement.  Issue 1-1-2:  As we discussed in issue 1-1-1, RAR can’t be precluded unless we can re-use the same requirement as in the connected mode. Therefore, we propose to not preclude the RAR until the EIRP spherical coverage requirement of msg1 is clear.  Issue 1-1-3: fine with option 1 and option 2  Issue 1-1-4: technically, we agree with the technical analysis from Nokia, so we are fine to have further discussion here. However, as a simpler way forward, it is also fine for us to adopt the same requirement as msg 1.  Issue 1-1-5: If the same requirement here means the same peak EIRP and spherical coverage EIRP, then we support option 1.  Issue 1-1-6: the core requirement should include all the cases defined in the WI, but test reduction can be further discussed.  Issue 1-1-8: No tolerance should be allowed.  Issue 1-1-9: option 2. Beam correspondence for initial access is a very fundamental UE capability and all UE should support since there is no other means for UE to select its uplink beam. Therefore, option 2 is the only feasible option.  Issue 1-1-10: option 1. In any case, we need to define the side condition of beam correspondence test. |
| Ericsson | **Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**  Option 1: this is the baseline with the same requirement as for connected mode. We show in R4-2216252 that the minimum spherical coverage requirement can be met with a wide beam.  Option 2: even better.  Option 3: no BC tolerance should be allowed.  Option 4: together with msg1 spherical coverage, a RAR measurement could verify correlation between TX and RX beams, beam correspondence, a constructive proposal in R4-2216785 of a combined msg1 and msg2 requirement (Proposal 5)  **Issue 1-1-2: RAR test**  Option 1 is preferred for more accurate verification (also depends on the side conditions for the msg1 spherical coverage).  **Issue 1-1-3: msg3**  Option 1 interesting (subject to msg3 power setting) but no strong view.  **Issue 1-1-4: msg 1 vs msg A**  Option 2.  **Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**  Option 1 should be the baseline for the spherical coverage requirement.  **Issue 1-1-6: Which scenario shall be included in core requirement**  Option 2. The same requirement could be applied to SDT (it is possible to keep the UE in the inactive state according to RAN5).  **Issue 1-1-8: BC tolerance metric**  None of the proposals, BC tolerance should be allowed.  **Issue 1-1-9: UE capability**  Option 2: the only possible option. BC fundamental for initial access performance in the field for all Ues.  **Issue 1-1-10: Side conditions**  Option 1. The SSB SNR used in the test should be considered. In our understanding, the SSB SNR used for the connect mode BC (spherical coverage) test is set to a level considerably higher than that experienced in the field at initial access, which means that the spherical coverage test may be less accurate for verifying correspondence between the TX and RX beams. This is why an msg2 test in addition to the msg1 spherical coverage is worth considering. We note that BC is important at all signal levels, it is a prerequisite for beam management in general. |
| AT&T | **Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**  Option 2.  **Issue 1-1-2: RAR test**  Option 1.  **Issue 1-1-3: msg3**  Option 2.  **Issue 1-1-4: msg 1 vs msg A**  Option 2.  **Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**  Option 1.  **Issue 1-1-6: Which scenario shall be included in core requirement**  Option 1. We agree with the comment made by Sony that the core requirement should include all the cases defined in the WI and test reduction can be further discussed.  **Issue 1-1-8: BC tolerance metric**  We support Option 4 (no BC tolerance relaxation) as proposed by QC.  **Issue 1-1-9: UE capability**  Option 2. The requirement should apply for all UEs.  **Issue 1-1-10: Side conditions**  Option 1. |
| Verizon | **Issue 1-1-1: min peak EIRP, EIRP spherical coverage, and BC tolerance**  Either Option 1 or 2.  **Issue 1-1-2: RAR test**  Option 1.  **Issue 1-1-3: msg3**  Either Option 1 or 2  **Issue 1-1-4: msg 1 vs msg A**  Option 2.  **Issue 1-1-5: Applicability of Rel-16 SSB BC requirement**  Option 1.  **Issue 1-1-6: Which scenario shall be included in core requirement**  Option 1: we agree with Sony and core requirement should include all the cases defined in the WI  **Issue 1-1-7: waveform**  Option 1  **Issue 1-1-8: BC tolerance metric**  Option 4 from Qualcomm (no BC tolerance relaxation)  **Issue 1-1-9: UE capability**  Option 2  **Issue 1-1-10: Side conditions**  Option 1. |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*For close-to-finalize Wis and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing Wis, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: Beam type and DRX issues

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2215512**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215512.zip) | Nokia, Nokia Shanghai Bell | **Observation 1:** Beam correspondence tests in the IDLE and INACTIVE modes need to be based solely on SSB reference signals  **Observation 2:** Existing SSB test configurations do not have enough samples to provide meaningful measurements for beam refinement procedures  **Observation 3**: During RA procedure, UE beam may switch from broad beam to narrow beam with power ramping and large preambleTransMax values?  **Observation 4:** EIRP spherical coverage is sensitive to beam refinement.  **Observation 5:** Short or long DRX cycles can last up to 640 and 10240 ms respectively. RRC\_INACTIVE and RRC\_IDLE states typically use longer DRX cycles  **Proposal 1:** Introduce purely SSB based tests for beam correspondence in IDLE and INACTIVE modes  **Proposal 2:** Increase the SSB periodicity or increase the number of SSB beams for SSB based beam correspondence tests.  **Proposal 3:** Beam refinement requirements in IDLE and INACTIVE modes need to consider the implications of longer DRX cycles in these modes  **Proposal 4:** Define UE beam correspondence requirements for RRC\_INACTIVE and IDLE mode considering DRX cycles as well as SDT types to ensure that UE beam correspondence is accurate in these UE power saving modes.  **Proposal 5**: Start with spherical coverage requirements initially. |
| [**R4-2215631**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215631.zip) | Apple | **Proposal 1: Fine beam and rough beam as well as the policy on beam selecting is UE implementation issue. There is no need to consider how UE will do the refinement for specification.**  **Proposal 2: The only SSB based beam correspondence requirement in R16 is applicable and**  **Proposal 3: DRX cycle is not relevant for beam correspondence test in initial access at maximum output power.** |
| [**R4-2215855**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215855.zip) | Huawei, HiSilicon | ***Proposal 1:*** *The Msg1 EIRP spherical coverage requirement for PC3 is [7+xdB] higher than the EIRP spherical coverage requirement specified in 6.2.1 for connected mode.*  ***Proposal 2:*** *For Msg1 beam correspondence, only EIRP spherical coverage requirement is specified.* |
| [**R4-2216130**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216130.zip) | vivo | **Observation 1:** UE is not always need to pursue a better uplink performance for initial access and SDT.  Proposal 1: No need to consider the beam refinement for initial access and SDT.  **Observation 2:** The beam type used during non-RRC\_CONNECTED state mostly depends on UE implementation.  **Observation 3:** The single element can be the worst case to accommodate all possible beam pattern.  **Proposal 1:** No need to consider the beam refinement for initial access and SDT.  **Proposal 2:** If the min peak EIRP and 50% spherical coverage is used as the RF requirement for non-RRC\_CONNECTED state, the single element should be the baseline for the rough beam.  **Proposal 3:** if UE can meet the R16 SSB-only beam correspondence without UL beam sweeping requirement, it can be considered that the UE can have similar beam correspondence performance in non-RRC\_CONNECTED state. |
| [**R4-2216439**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216439.zip) | OPPO | **Observation 1: 7dB gain difference between rough and fine beam is defined which can be used as reference in beam correspondence discussion. Beam Types used in the initial access is not limited by RRM spec.**  **Proposal 1: Both rough beam and fine beam UE implementation in the initial access are considered in the beam correspondence requirement definition process.**  **Proposal 2: Whether UE will change the beam from rough beam to fine beam when tested under MOP is up to UE implementation. Beam correspondence requirement should accommodate both.**  **Observation 2: Peak EIRP will be different from Rel-16 SSB only based case if UE keep rough beam unchanged** **in initial access.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1 Beam refinement

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-1-1: Rough beam vs Fine beam**

* Proposals
  + Option 1: The single element should be the baseline for the rough beam. Rough beam is as basis for initial access and RA-SDT Supported by vivo, CMCC
  + Option 2: Define requirement for both rough beam and narrow beam. Supported by OPPO
  + Option 3: No need to consider rough/fine beam in requirement as it is implementation matter. Supported by Qualcomm, Xiaomi, OPPO, Apple, Sony, Ericsson, AT&T, Verizon
  + Option 4: Consider the implications of DRX cycles in beam refinement. Supported by Nokia
  + Option 5: In RRM specification, rough beam is assumed for random access. If fine beam is assumed for RF specification, it should be guaranteed that fine beam could be triggered for all UE implementations. Supported by Samsung
* Recommended WF
  + In GTW, discuss the beam assumption for IA, RA-SDT, and CG-SDT if rough beam is used or fine beam is used. Is it different for IA, RA-SDT and CG-SDT? Does requirement depend on beamwidth?

**Issue 2-1-2: Gain difference**

* Proposals
  + Option 1: Consider 7 dB between rough and fine beam as in 38.133 Supported by vivo, Huawei, OPPO, Samsung (if rough beam is assumed)
  + Option 2: No need to consider. Supported by Qualcomm, Nokia, Xiaomi, Apple, Sony, Ericsson, AT&T, Verizon
* Recommended WF
  + TBA

**Issue 2-1-3: SSB configured to enable beam refinement**

* Proposals
  + Option 1: yes (such as increasing periodicity and number of SSB beams) Supported by Nokia, Ericsson (or to set a very high received target power)
  + Option 2: no (the same as Rel-16 is ok) Supported by Qualcomm, Xiaomi, Apple
  + Option 3: FFS (it depends on beam assumption) Supported by Samsung, vivo, Sony
  + Option 4: Not clear if it helps. Supported by Huawei
  + Option 5: There is no guarantee that UE will do beam refinement with certain SSB configuration. Supported by OPPO
* Recommended WF
  + TBA

### Sub-topic 2-2 DRX

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2-1: DRX test**

* Proposals
  + Option 1: Yes, DRX test is included Nokia
  + Option 2: No Qualcomm, Samsung, vivo, Huawei, Xiaomi, OPPO, Apple
* Recommended WF
  + In GTW, discuss whether DRX requirement/test is included.

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |
| Qualcomm | Issue 2-1-1: Option 3. Note: UE needs enough time at test grid point to refine its beam towards the agreed MOP test condition (i.e. same as in connected mode case)  Issue 2-1-2: Option 2  Issue 2-1-3: Option 2  Issue 2-2-1: Option 2 |
| Samsung | **Issue 2-1-1: Rough beam vs Fine beam**  In RRM specification, rough beam is assumed for random access. If fine beam is assumed for RF specification, it should be guaranteed that fine beam could be triggered for all UE implementations.  **Issue 2-1-2: Gain difference**  Depending on beam assumption. If rough beam is assumed, option 1 can be starting point.  **Issue 2-1-3: SSB configured to enable beam refinement**  No decision before consensus on how beam refinement works, especially the difference from connected mode  **Issue 2-2-1: DRX test**  Option 2. |
| vivo | Issue 2-1-1:  Prefer option 1. We understand the beam type is implementation issue, but the requirement should  consider the worst case.  Issue 2-1-2:  Option 1. For min peak EIRP (if need to be defined), 7 dB gain difference can be considered. For  50% spherical coverage, the gain difference can be further evaluated.  Issue 2-1-3:  Others, we should conclude whether rough beam need to be considered first.  Issue 2-2-1:  Option 2. |
| Huawei | **Issue 2-1-1: Rough beam vs Fine beam**  At least the RRM assumption of difference between rough beam and fine beam needs to be considered. Whether single element could be used as baseline needs further discussion.  **Issue 2-1-2: Gain difference**  Option 1.  **Issue 2-1-3: SSB configured to enable beam refinement**  It’s not clear how increased SSB periodicity or SSB beam could help UE beam searching. To my understanding, UE could do the DL measurement for 1 Rx beam in each SSB periodicity, and the minimum time that UE needs to finish the beam selection is (number of Rx beam X SSB periodicity).  If there are multiple SSB beams, UE needs to do the beam selection for each SSB beam independently, therefore the selection time can’t be reduced.  **Issue 2-2-1: DRX test**  Option 2. DRX is not configured yet for initial access. |
| CMCC | **Issue 2-1-1: Rough beam vs Fine beam**  We prefer option 1.  **Issue 2-1-3: SSB configured to enable beam refinement**  For option 1, how could we add SSB beams since the max SSB beam is already fixed and actual network normally transmit with max number? |
| Nokia | **Issue 2-1-1:** Option 4. Idle and Inactive modes have long DRX cycles. Implications of these need to be considered while defining BC requirements.  **Issue 2-1-2:** Option 2  **Issue 2-1-3:** Option 1. We propose to either increase the SSB periodicity or increase the number of SSB beams for SSB based beam correspondence tests in order to enable UE to refine its beams  **Issue 2-2-1:** Option 1 |
| Xiaomi | Issue 2-1-1: Option 3.  Issue 2-1-2: Option 2.  Issue 2-1-3: Option 2.  Issue 2-2-1: Option 2. No DRX is configured in RA process. |
| OPPO | **Issue 2-1-1: Rough beam vs Fine beam**  Option 2: Define requirement for both rough beam and narrow beam.  Option 3: No need to consider rough/fine beam in requirement as it is implementation matter.  **Issue 2-1-2: Gain difference**  Option 1: Consider 7 dB between rough and fine beam as in 38.133  **Issue 2-1-3: SSB configured to enable beam refinement**  None, beam refinement is up to UE implementation, there is no guarantee that UE will do beam refinement with certain SSB configuration.  **Issue 2-2-1: DRX test**  Option 2: No |
| Apple | Issue 2-1-1: Option 3. The test is under MOP which means UE needs to use similar beam as in RRC\_CONNECTED state to get comparable gain to achieve the same MOP.  Issue 2-1-2: Option 2  Issue 2-1-3: Option 2  Issue 2-2-1: Option 2 |
| Nokia | **Issue 2-1-3: SSB configured to enable beam refinement**  This can enable UE to refine its beams and speed up test procedure. Tests defined today have only 2 SSB beams and periodicity is 20 ms. With 2 beams you cannot compare different beams, even broad beams. If there are 3-4 panels + averageing needs more than 2 ssb beams and narrow beams (if UE uses that) needs even more SSB beams. Having more SSB samples will definitely help the beam refinement procedure.  It eventually will save time and easy to be implemented. Also it increases the flexibility of various test cases. For example, MOP test.  **Issue 2-2-1: DRX test**  DRX is configured in idle and inactive mode, BC requirements for idle and inactive need to be considered. the fact that UE will have long DRX cycles here need to be factored in as well. Therefore we need to consider DRX test. |
| Sony | Issue 2-1-1:  Option 3 No need to consider rough/fine beam in requirement as it is implementation matter.  But we just also want to point out that it is also possible to meet the 50% spherical coverage requirement with a wide beam based on our analysis.  Issue 2-1-2:  Option 2  Issue 2-1-3:  We are open to further discuss how to configure the SSB. |
| Ericsson | **Issue 2-1-1: Rough beam vs Fine beam**  Option 3: up to UE implementation.  **Issue 2-1-2: Gain difference**  Option 2-  **Issue 2-1-3: SSB configured to enable beam refinement**  Option 1: the SSB periodicity may have to considered since the RACH procedure is also used for “power control”. An alterative is to set a very high received target power such that theb UE can only transmit at maximum power. |
| AT&T | **Issue 2-1-1: Rough beam vs Fine beam**  Option 3.  **Issue 2-1-2: Gain difference**  Option 2. |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize Wis and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going Wis, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: Test issues

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2215480**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215480.zip) | CMCC | **Observation 1: if UE changes its UL beam before come to max output power, then UE can’t achieve max output power according to 38.321 anymore.**  **Observation 2: implication on UE implementation of beam/panel choice could only help to know whether UE could transmit with max power but it actually can’t help to let UE transmit with max power.**  **Observation 3: We should make sure UE has achieved max power before PREAMBLE\_TRANSMISSION\_COUNTER equal to max value.** |
| [**R4-2215513**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215513.zip) | Nokia, Nokia Shanghai Bell | **Observation 1:** Beam lock function is unavailable in IDLE and INACTIVE modes.  **Observation 2:** Increasing the ra-Responsewindow to a large value will also increase the test time.  **Observation 3:** When the ra-Responsewindow is set to a large value, the parameters used for the power ramping procedure (i.e., preambleTransMax, powerRampingStep and the preambleReceivedTargetPower) during the random access can be scaled as per requirements to reduce the interim steps. However, since the raResponse window is large, the test time will still be large.  **Observation 4:** Inactive and Idle mode have different types of scenarios with some needing higher requirements than others due to e.g., SDT.  **Proposal 1:** Introduce a new RA response timer for the last RA transmission such that UE holds the beam for a longer period of time.  **Proposal 2:** Define a new test for state transition from CONNECTED to INACTIVE mode.  **Proposal 3:** Scenarios to be tested can be grouped into categories based on the requirements for each one of them. |
| [**R4-2215632**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215632.zip) | Apple | **Proposal 1: It is proposed to check with RAN5 whether beam lock function can be defined for beam correspondence testing in initial access.** |
| [**R4-2215636**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215636.zip) | Apple | LS on beam lock function for beam correspondence test in initial access |
| [**R4-2215702**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215702.zip) | Samsung | **Observation 1: in RRM specification for random access, rough beam is assumed which does not limit UE implementation or test system implementation**  **Proposal 1: If rough beam were to be assumed for RF requirements, then it is not necessary to specify peak EIRP for beam correspondence requirements, and spherical EIRP is enough.**  **Observation 2: holding RAR to enable power ramping of preambles has been adopted in RRM specifications and relative power requirement of power ramping indicates that no TX beam change during power ramping**  **Proposal 2: Holding RAR to enable maximum output power is feasible by well-defined parameters including the calibrated power of the first preamble, the power ramping step parameter, and the preamble numbers for power ramping.**  **Proposal 3: It is just necessary to specify the spherical coverage performance of random access beam correspondence at the 50%-tile direction obtained from RRC\_connected spherical coverage.**  **Proposal 4: the testability limitation on polarization aspect can be addressed with following metric:**  **EIRP = maximum (EIRP(PolMeas=PolLink=), EIRP(PolMeas=PolLink=)) + ,**  **where is the ratio of  component EIRP and  component EIRP obtained from RRC\_connected measurement in dB unit** |
| [**R4-2215856**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215856.zip) | Huawei, HiSilicon | ***Observation 1:*** *The UE TX beam switching when RAR is held would have impact on EIRP spherical measurement result.*  ***Proposal 1:*** *The maximum output power of Msg1 could be achieved by properly configuring the parameters of* *ss-PBCH-BlockPower and preambleReceivedTargetPower.* |
| [**R4-2216131**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216131.zip) | vivo | **Observation 1:** Both test UEs in RRC\_INACTIVE mode and trigger SDT are feasible.  **Observation 2:** The msg1 retransmission time depends on the configuration of *preambleTransMax* and *ra-ResponseWindow.*  **Observation 3:** The msg1 may be transmitted with max output power at the first time by a specific configuration.  **Proposal 1:** No need to test beam correspondence performance of SDT, and once the UE can pass the beam correspondence test for initial access, the SDT can be considered to meet the requirements as well.  **Proposal 2:** For each test point, the IA procedure should be initialized and the *preambleTransMax* and *ra-ResponseWindow* need to guarantee the retransmission time is larger than the time of one test point. |
| [**R4-2216440**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216440.zip) | OPPO | **Proposal 1: Hold on the discussion of MSG A, and focus on MSG1 beam correspondence considering two step RACH is an optional feature and not part of WID.**  **Observation 1: It is unclear how and why UE will change its RAR receive beam different from MSG1 Tx beam considering the only reference signal SSB is unchanged in the initial access.**  **Proposal 2: The necessity of RAR test needs to be justified first before requirement discussion.**  **Observation 2: BEAM\_LOCK function is a nice to have function for test system, if supported then test system probably can be simplified by using one antenna for both communication and measurement purpose, but without this function the Tx performance can also be measured via separate communication and measurement antennas.**  **Proposal 3: Separate communication and measurement antennas will be used in the test system for IA Beam correspondence requirements (peak EIRP/spherical) considering the missing of BEAM\_LOCK function.**  **Observation 3: When NW doesn’t send RAR, UE will try the preamble transmission with max 200 times configured by *preambleTransMax* IE defined in 38.331, after that RACH failure will happen.**  **Observation 4: After RACH failure, UE will wait for a period and retransmit the preamble, but how long the waiting period is up to implementation. If long, then there will be testability issue.**  **Proposal 4: Study the potential testability issue caused by RACH failure due to exceeding max number of RA preamble transmission times configured by *preambleTransMax* {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200}.**  **Observation 5: UE probably will change its beam during initial access especially when not receive RAR, but after a long enough time (FFS) the status should be stable.**  **Proposal 5: UE is allowed to change its beam during the initial access, but UE transmit beam status should be unchanged in the end for power measurement.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1 Test function

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3-1-1: Feasibility to achieve maximum output power**

* Proposals
  + Option 1: A new test functionality should be considered as in Issue 3-1-2. Supported by Nokia
  + Option 2: Feasible by holding RAR with well-defined parameters. Supported by Qualcomm, Samsung, vivo, OPPO, Sony, Ericsson, AT&T
  + Option 3: Study the potential testability issue caused by RACH failure due to exceeding max number of RA preamble transmission times. Supported by OPPO
  + Option 4: UE is allowed to change its beam during the initial access, but UE transmit beam status should be unchanged in the end for power measurement. Supported by OPPO
  + Option 5: Maximum output power could be achieved for first preamble transmission by well-defined parameters. Supported by Huawei, CMCC, Apple, Sony, Ericsson

**Issue 3-1-2: New Test functionality**

* Proposals
  + Option 1: Ask RAN5 if beam lock can be defined. Supported by Apple, Nokia, Ericsson, AT&T
  + Option 2: Introduce a new RA response timer for UE to hold the beam for a longer period of time. Supported by Nokia
  + Option 3: No particular new test function is needed. Supported by Qualcomm, vivo, OPPO
  + Option 4: FFS: Supported by Samsung, vivo, Huawei
  + Option 5: Can be up to RAN5, Supported by Sony
* Recommended WF
  + TBA

### Sub-topic 3-2 Test scenario

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 3-2-1: Test scenario**

* Proposals
  + Option 1: Define a new test for state transition from CONNECTED to INACTIVE mode. Scenarios to be tested can be grouped into categories based on the requirements for each one of them. Supported by Nokia
  + Option 2: No new test scenario Supported by Samsung, vivo, Huawei (only IA), OPPO, Apple (Only IA)
  + Option 3: Others Supported by Qualcomm
* Recommended WF
  + TBA

### Sub-topic 3-3 Polarization aspects

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 3-3-1: polarization aspects**

* Proposals
  + Option 1: **addressed with following metric:**

**EIRP = maximum (EIRP(PolMeas=PolLink=), EIRP(PolMeas=PolLink=)) + ,**

* + - **where is the ratio of  component EIRP and  component EIRP obtained from RRC\_connected measurement in dB unit** Supported by Samsung
  + Option 2: Separate communication and measurement antennas will be used in the test system for IA Beam correspondence requirements (peak EIRP/spherical) considering the missing of BEAM\_LOCK function. Supported by OPPO
  + Option 3: Others
  + Option 4: the same as connected, Supported by Qualcomm
  + Option 5: FFS, Supported by Huawei, Apple, AT&T
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |
| Q**ualcomm** | Issue 3-1-1: Option 2. Note: We would like to avoid test modes where not necessary (so, no option 1), and we think the UE’s best effort EIRP should be used in the option 3 scenario.  Issue 3-1-2: Option 3  Issue 3-2-1: Option 3  Issue 3-3-1: Option 3 Note: We do not foresee anything other than the connected mode set up. For this requirement, the measurement procedures from connected mode may need to be modified to ensure the UE has finished its power ramp. |
| Samsung | **Issue 3-1-1: Feasibility to achieve maximum output power**  Currently option 2 is most preferred, but open to option 1 before feasibility of option 2 is confirmed.  For the issues raised in option 3 and 4, test parameters of option 2 should be well defined to avoid such detailed issues.  **Issue 3-1-2: New Test functionality**  In last meeting RAN4 agreed that beam lock mode is not available for initial access. But generally speaking, the door for new test function should not be closed before testability related issues could be solved.  **Issue 3-2-1: Test scenario**  Option 2.  **Issue 3-3-1: polarization aspects**  Support Option 1, as proponent. The testability issue of without beam lock has to be solved, otherwise the measured maximum output power will be lack of a component EIRP.  For option 2, separate link antenna and measurement antenna are applicable for different AoA case, i.e. link antenna in AoA1 and measurement antenna in AoA2. But for beam correspondence, the link antenna and measurement antenna could not be separated. |
| vivo | Issue 3-1-1:  Option 2 is ok.  Issue 3-1-2:  Prefer option 3 for now. For option2, enlarge the RAR monitor window will impact the RACH power  control  procedure, so we don’t think it is feasible.  Issue 3-2-1:  Option 2. UE can enter RRC\_INACTIVE by receiving release from TE, we don’t know the intention  for this transition mode.  Issue 3-3-1:  No strong view on this issue, maybe we can discuss this issue after we figure out whether beam  change exist and how to avoid it. |
| Huawei | **Issue 3-1-1: Feasibility to achieve maximum output power**  Propose to consider a new option:  Option 5: Maximum output power could be achieved for first preamble transmission by well-defined parameters.  **Issue 3-1-2: New Test functionality**  Could be further discussed after the testability issue is clarified.  **Issue 3-2-1: Test scenario**  Option 2. It’s preferred to consider IA only.  **Issue 3-3-1: polarization aspects**  Option 1 needs further study. It’s not clear how to maintain the same condition for Connected and IDLE to make sure the power ratio is not changed. In addition, if the UE beam for Connected and IDLE is not the same, whether the power ratio is always the same is a question.  Option 2 seems feasible if test equipment could support this implementation. In addition, it needs to be clarified first whether current test equipment could receive with both polarizations simultaneously. This function seems necessary for testing the UL-MIMO test cases. |
| CMCC | **Issue 3-1-1: Feasibility to achieve maximum output power**  Option 5 is preferred as proposed by Huawei. The issues that will cause UE not transmiting with max power include exceeding max number of RA PREAMBLE counters and also the case when UE change its Tx beam. |
| Nokia | **Issue 3-1-1:** Option 1  **Issue 3-1-2:** Option 2. However, we are also open to Option 1  **Issue 3-2-1:** Option 1. It will be beneficial to have test defined in INACTIVE mode. Given that SDT has been defined for INACTIVE mode, the granularity in BC requirements need to be defined keeping in mind that SDT can be either a 4 step or a 2 step RA SDT. Accordingly these requirements have to be tested as well. |
| OPPO | **Issue 3-1-1: Feasibility to achieve maximum output power**  Option 2: Feasible by holding RAR with well-defined parameters.  Option 3: Study the potential testability issue caused by RACH failure due to exceeding max number of RA preamble transmission times.  Option 4: UE is allowed to change its beam during the initial access, but UE transmit beam status should be unchanged in the end for power measurement.  **Issue 3-1-2: New Test functionality**  Option 3: No particular new test function is needed.  **Issue 3-2-1: Test scenario**  Option 2: No new test scenario  **Issue 3-3-1: polarization aspects**  Option 2: Separate communication and measurement antennas will be used in the test system for IA Beam correspondence requirements (peak EIRP/spherical) considering the missing of BEAM\_LOCK function. |
| Apple | Issue 3-1-1: Share the same view as Huawei.  Option 5: Maximum output power could be achieved for first preamble transmission by well-defined parameters.  Issue 3-1-2: Option 1. We think it is necessary and should be checked with RAN5.  Issue 3-2-1: Only test IA.  Issue 3-3-1: FFS later. |
| Sony | Issue 3-1-1:  Option 2.  As an alternative solution, it is also possible for the TE to set an artificial value so that the UE will transmit with high power from the beginning.  Issue 3-1-2:  Maybe we can leave the testability issue to RAN5, and RAN4 can focus on the core requirement and side condition discussion. |
| Ericsson | **Issue 3-1-1: Feasibility to achieve maximum output power**  Option 2. Alternatively a very high ‘impossible’ target received preamble power is set in the RACH procedure.  **Issue 3-1-2: New Test functionality**  Option 1: it is worth asking RAN5 what can be done in terms of test modes for the different RRC states. |
| AT&T | **Issue 3-1-1: Feasibility to achieve maximum output power**  Option 2 should be the baseline. Option 1 should only be considered if the feasibility of Option 2 is not confirmed.  **Issue 3-1-2: New Test functionality**  Option 1.  **Issue 3-3-1: polarization aspects**  Option 3. This can be discussed later. |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents